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# Factors Contributing To Positive Nutritional Deviance in the Growth of Children Aged 6-36 Months in Rural Northern Ghana

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## Abstract

The main aim of the study was to find out why some children are nutritionally better-off than others although they belong to the same environmental setting. This cross-sectional study conducted in rural Northern Ghana, compared nutritional positive deviant children (that is, neither stunted nor wasted) with children having at least one form of under nutrition with respect to household feeding care practices and other health seeking behaviours. Of the 1,168 children aged 6-36 months, 67.9 % (CI: 64.5 – 71.1) were classified as positive deviant (PD). The prevalence of stunting and wasting was 23.1 (CI: 19.4 - 27.3), 12.8 (CI: 10.9 - 14.8) respectively. Multivariable logistic regression adjusted for cluster sampling showed that positive deviant children (that is, neither wasted nor stunted) were 1.9 times more likely to be female children [AOR 1.88; 95% CI (1.32 - 2.67)]. Younger children (6-8 months) were 13.7 times more likely of being positive deviant children [AOR 13.66; 95% CI (5.51 - 33.90)], compared to children aged 24-36 months. Children who were not breastfeeding were more likely to be positive nutritional deviants as compared to their counterparts who were breastfeeding [AOR 2.80; 95% CI (1.62 - 4.82)]. There was little variation in the diets of positive deviants and the rest of the children (that is negative deviants and median growers), an indication that factors other than diet may be contributing to better growth of children in Northern Ghana.

**Keywords:** IYCF Practices; Nutritional Status; Positive Deviance; Complementary Feeding Northern Ghana

## Introduction

Child under nutrition continues to be a public health problem in Northern Ghana. A number of interventions have been implemented to address the issue but progress remained slow and this calls for better and improved ways of dealing with the problem. It is generally agreed that the underlying causes of malnutrition among children are household food insecurity, inadequate care and poor access to health services coupled with poor personal and environmental hygiene [1]. However, variability in growth and nutritional status of children exists even when there is no substantial difference in care, health, and food accessibility, meaning that children having similar living conditions such as disposable income and resource access grow adequately, while others fail to do so in the same household [2-4].

In particular, it is usually believed that households with high income level or socioeconomic status will also have the best nutritional status. This has been found not to be true in all cases and there are research findings that support this. For example, a study in Bangladesh showed that the association between income level and child nutritional status was not evident, because there had been instances where children in very poor households did grow better than others with the best socioeconomic status struggle to grow [5]. This suggests that there must be some hidden factors and/or practices that could be yielding these positive as well as negative results. Many experts believe that this phenomenon can be explained by what is being referred to as "nutritional positive deviance". The term "positive deviance" in nutrition has been used to identify children who 'grow and develop well in impoverished environments where majority of children are victims of malnutrition and chronic illness, whereas, 'negative deviants' grow at the lower end of the growth spectrum and 'median growers' grow at or around the median of the growth spectrum [5]. In situations where a child exhibits the best growth under harsh living conditions, then that child is described as positive deviant [6]. A lot can be learnt from positive deviant children providing guidance to design appropriate nutrition programmes in communities to address the problem of malnutrition among children. For example, programmes can be designed to discourage behaviors that are associated with negative deviance, and to promote behaviors that are associated with positive deviance. To do this effectively, we need to have better understanding of the factors that promote positive deviance in child growth. However, there is little systematic investigation on the magnitude and determinants of positive deviance in the growth of children in Northern Ghana and this warrants further research. The International Institute of Tropical Agriculture (IITA)-Ghana in collaboration with the Ghana Health Service (GHS) has initiated a new project which seeks to identify and promote the consumption of locally available micronutrient-rich foods including vegetables, fruits, and animal-source foods (ASF) to improve dietary diversity and nutritional outcomes of children, pregnant and lactating mothers.

In November 2013, a baseline survey was conducted in IITA programme communities. The overall aim of the survey was to collect information on knowledge and practices related to infant and young child feeding (IYCF) practices which will serve as a baseline for future comparison after the implementation of the project. This paper is based on re-analysis of data from the baseline survey to find out why some children are nutritional better-off than others although they belong to the same environmental setting.

## Methods and Materials

### Survey design, population and sampling

This was a cross-sectional baseline survey carried out November 2013. The study population comprised mothers/primary caregivers and their children aged 6-36 months, selected from 25 programme communities. A sample size of 288 was required to ensure that the estimated prevalence of chronic malnutrition was within plus or minus 5 % of the true prevalence at 95% confidence level. Assuming a correction factor of 2 (the "design effect") for cluster sampling the sample size was increased to 576. A non response rate of 5 % and other unexpected events (e.g. damaged/incomplete questionnaire) was factored in the sample size determination and so the sample size was adjusted to 600. The same number of children was selected from comparison communities where the interventions were taking place but were located in the same district.

In each cluster, a complete list of all households was compiled and systematic random sampling used in selecting study households. All the households in each cluster were serially numbered. To get the sampling interval, the total number of households in a cluster was divided by the sample size of 24. The first household was then randomly selected by picking any number within the sample interval. Subsequent selections were made by adding the sampling interval to the selected number in order to locate the next household to visit. If the selected household does not have a target respondent, then next household was selected using the systematic sampling procedure. This process continued until the required sample size was obtained. A minimum of 24 mother/child pairs were randomly selected from a cluster giving a total of 600 respondents per study arm.

## Data collection

Anthropometric assessment as well as household interviews, using structured questionnaires was undertaken concurrently. During the interview, mothers were asked questions about family demographics, child feeding practices, specific foods consumed by the child, child care practices, healthcare seeking behavior and home management of sick children.

### Independent and dependent variables

The main outcome variable for this study was the prevalence of child's nutritional deviance. The independent variables for this study were infant and child feeding practices, child and household characteristics. A brief description of main independent and dependent variables is as follows:

### Assessment of infant and young child feeding (IYCF) practices

Infant and young child feeding indicators including minimum meal frequency**,** minimum dietary diversity and minimum acceptable diet were estimated by recall of food and liquid consumption during the previous day of the survey as per

WHO/UNICEF guidelines [7]. An adapted version of infant and child-feeding index (ICFI) originally developed by Ruel and Menon [8] included the following dimensions: current breast-feeding status; dietary diversity in the past 24 hours; adequacy of meal frequency in the past 24 hours prior to the study, score for timely initiation of breast feeding, score for whether or not child was fed with prelacteal food, and score for timely introduction of complementary foods.

A dietary diversity score was created by summing consumption of 16 types of food groups: cereals, white roots and tubers, vitamin A rich vegetables and tubers, legumes and nuts, milk and milk products, dark green leafy vegetables, flesh meats, organ meat, fish, eggs, vitamin A-rich fruits, other fruits, other vegetables, oils and fats, sweets, and spices and condiments.

The dietary diversity score ranged from 0-16 with minimum of 0 if none of the food group was consumed to 16 if all the food groups are consumed. From the dietary diversity score, the minimum dietary diversity indicator was constructed using the WHO recommended cut-off point with a value of "1" if the child had consumed four or more groups of foods and "0" if less. Minimum dietary diversity is the proportion of children who ate at least 4 or more varieties of foods from the seven food groups in a 24 hour time period [9, 10]**.** Minimum meal frequency is the proportion of children who received complementary foods the minimum recommended number of times in 24-hours. For breastfed children, the frequency should be at least 2 times for 6–8 months, and at least 3 times for 9 –23 months of age. For non-breastfed children, it should be at least 4 times in last 24 hours. Minimum acceptable diet is a composite indicator of minimum dietary diversity and minimum meal frequency. When a currently breastfed child meets both the minimum diversity and the minimum meal frequency, the child is considered to have met the WHO recommended minimum acceptable diet.

**Determination of educational level**

Maternal educational level was based on the highest level attained according to the Ghanaian System where primary education consist of six years of formal education, the Junior High School (JHS) is nine years, Senior High School (SHS) is 13 years. This variable was categorized into three: no education, primary or junior secondary, senior secondary education or higher.

**Anthropometric indicators**

Anthropometric indicators of height-for-age (HAZ), weight-for-age (WAZ), weight-for-height (WHZ) were determined as recommended by the World Health Organization [11]. In most studies, one growth indicator is often used to define positive or negative nutrition deviance. However, a child who is not stunted may still be wasted or vice versa. Consequently, we defined positive deviant children as having both height - for -age Z-score (HAZ) and weight – for height Z-score (WHZ) ≥-2 (better nutritional status) were compared with the rest of the children (that is, those having their HAZ and/or WHZ <-2 ( worse nutritional status).Negative deviant child was defined as having both HAZ and WHZ <-2. Median deviant child was defined as having either HAZ or WHZ <-2.

**Data management and statistical analyses**

The Emergency Nutrition Assessment (ENA) software (2013 version) was used for the anthropometric data analysis and reported using WHO 2006 growth reference values. Data analyses were performed using procedures in SPSS complex samples module, version 18.0 for Windows. Design weights were added to each region (that is, total population divided by number of respondents) to perform weighted analysis. This module of SPSS takes into account the complex nature of the cluster sample design.

Before performing the anthropometric calculations for weight-for-height (WH), height-for-age (HA) and weight-for-age (WA), the data was cleaned and outliers removed. In bivariate analyses, the chi-square tests were carried out to test for differences between positive and negative deviant children. Differences between the study groups were considered to be statistically significant if the P value was less than 0.05, or if the range for the 95% confidence interval for the odds ratio (done as part of the analysis) did not include 1.0. We then used logistic regression with adjustment for clustering in SPSS complex sample to identify independent predictors. The risk factors that were statistically significant or close to significant associations in the bivariate analyses were entered into the logistic regression.

**Ethics and informed consent**

The study was also approved by the School of Medicine and Health Sciences, University for Development Studies. Informed verbal consent was sought through verbal communication with community representatives and on individual household level, with accompanying clarification on purpose and nature of the study. In each household, the survey team supervisor gave a brief orientation to the respondents as to the purpose and intended outcome of the study. He/she read and explained the informed consent statement to the mothers. All mothers approached opted to participate in the survey.

## Results

A total 1,200 children aged 6-36 were surveyed but some of them had missing data and were therefore excluded from the analysis.

**Socio-demographic characteristics of the sample**

As shown in Table 1, the mean (standard error) age of children included in the analysis was 18.9± 0.3 months and 48.9 % were male. The mean (standard error) age of the mothers was 28.9±0.15 years. Nearly 71.0 % (CI: 67.5 - 74.0) of the mothers had no formal education.

**Table 1.** Sample Characteristics

| Child Characteristics | Frequency (n) | Mean ± S.E | Percentage (%) |
|---|---|---|---|
| % Male | 585 | | 48.9 (CI: 46.4 - 51.5) |
| Mean Age (months) | 1175 | 18.9 ± 0.3 | |
| Age distribution (months) | | | |
| 6-8 | 131 | | 11.4 (CI: 9.4 - 13.7) |
| 9–11 | 148 | | 12.2 (CI: 10.6 - 14.0) |
| 12-23 | 495 | | 43.3 (CI: 40.1 - 46.5) |
| 24- 36 | 401 | | 33.2 (CI: 29.8 - 36.7) |
| Children 6-36 months who had diarrhoea at least once in the past 14 days | 395 | | 33.8 (CI: 29.9 - 37.9) |
| Timely initiation of breast feeding | 540 | | 48.2 (CI: 44.2 - 52.3) |
| Timely Complementary Feeding (infants 6–8 months) | 131 | | 34.8 (CI: 26.6 - 43.9) |
| Minimum meal frequency | 455 | | 59.7 (CI: 55.1 - 64.2) |
| Minimum dietary diversity (≥ 4 food groups) | 270 | | 35.0 (CI: 30.9 - 39.3) |
| Minimum Acceptable diet | 187 | | 27.2 (CI: 23.2 - 31.6) |
| Maternal Characteristics | | | |
| Mean Age (Years) | 1175 | | |
| **Educational level** | | | |
| No schooling | 831 | | 70.9 (CI: 67.5 - 74.0) |
| Low (Primary school and JHS/Middle) | 314 | | 26.5 % (CI: 23.9 - 29.2) |
| High (at least Secondary school) | 30 | | 2.7 % (CI: 1.7 - 4.0) |

**Household Food Availability, Access and Utilization**

The primary source of obtaining food for 92.5 % of households was their own production (e.g. farming). Most households (98.0 %) reported cultivating grains, roots, tubers but less than 5 % grow orange or yellow fruits and vegetables. The cultivation of leafy green vegetables was reported in only 30 % of households (Figure 1).

With respect to household livestock and poultry keeping, 4.9 % of the sampled households did not keep any animal or bird. Fig 2 shows the types of animals and poultry owned by households. Whereas, over 80 % of households keep chickens, ducks, or other birds; for the meat/sale, only 28.2 % do so for their eggs. Livestock such as cows, goats, sheep, or dogs are kept mainly for sale (59.7 %) but 51.1 % of households reported keeping these animals for the sake of meat. Keeping rabbits, guinea pigs, or other small ruminants was practiced by less than 5 % of households. Fish farming was rarely practiced in the study population.

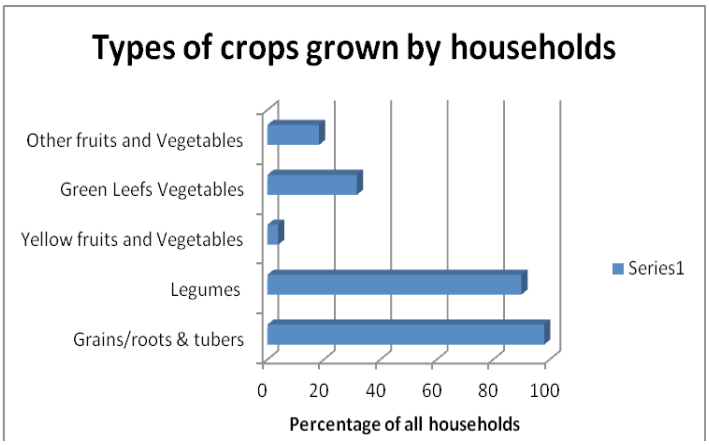


**Figure 1.** Types of crops grown by households.

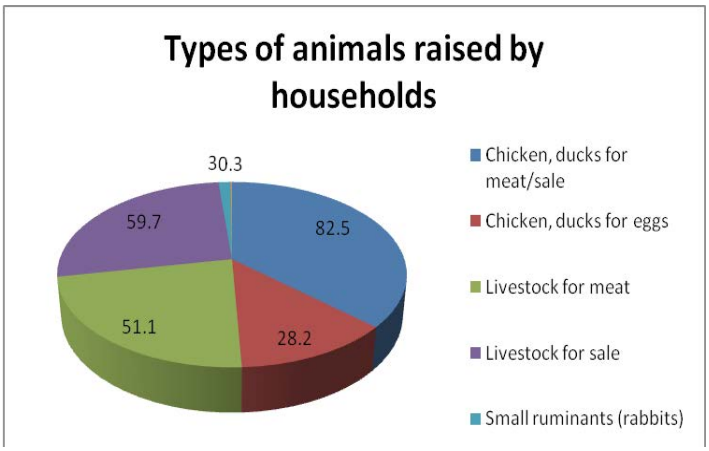


**Figure 2.** Types of animals raised by households

## Food Consumption/Utilization

As shown in Figure 3, the types of food that were fed to children in the past 24 hours prior to the study were cereal-based staples, but the consumption of foods known to have a good content of micronutrients and protein was less than satisfactory. For example, only 14.3 % of children were fed on vitamin A rich fruits and vegetables. Consumption of flesh meat was reported in less than 12 %. Legumes consumption was reported in 45.5 % of the households interviewed.

Organ meats and other animal products - dairy and eggs - were consumed quite infrequently. Dark green, leafy vegetables were consumed by 37.9 % of the children. Consumption of fats and oils was modest (56.3 %). The consumption of dried vegetables such as okro, pumpkin, baoba leaves, and wild types in the past 24 hours was reported by 43.2 % of the households.

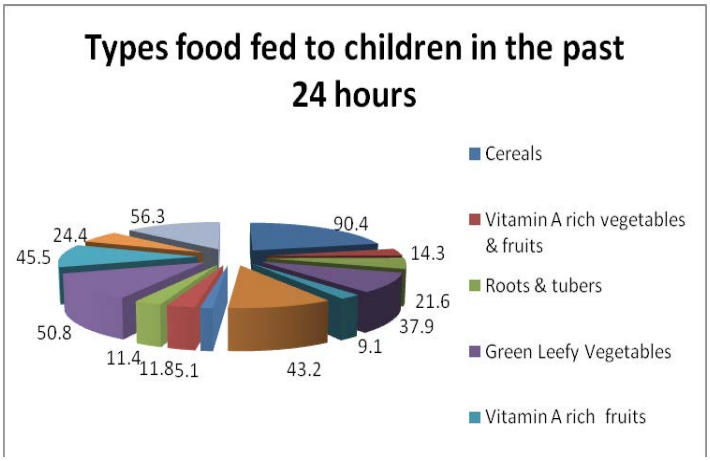


**Figure 3.** Types of food fed to children in the past 24 hours

## Dietary Diversity and Food Group Frequency Consumption

The mean dietary diversity score (DDS) from 7 food groups was 2.8±1.7. Of the 765 children aged 6–23 months, 35.0 % met the minimum dietary diversity (≥ 4 food groups), and only 27.2 % had received an acceptable diet.

The results showed that there was no discernible difference between positive deviant children and negative/median growers in terms of dietary intake in the past 24 hours prior to the study, except that a greater proportion of positive deviant children consumed more legumes compared with the rest of the children (66.7 % versus 33.3 %) $\chi 2 = 5.9$ p = 0.015 (Table 2).

**Table 2.** Type of food groups consumption frequency in the past 24 hours.

| Food Type | N | Classification of positive deviance | | |
|---|---|---|---|---|
| | | Positive deviants n (%) | Negative deviants & median growers n (%) | Test statistic |
| **Cereals** | | | | |
| No | 110 | 84 (76.4) | 26 (23.6) | $\chi^2 = 2.2$ p = 0.14 |
| Yes | 1075 | 748 (69.6) | 327 (30.4) | |
| **Roots and tubers** | | | | |
| No | 928 | 663 (71.4) | 265 (28.6) | $\chi^2 = 3.1$ p = 0.08 |
| Yes | 257 | 169 (65.8) | 88 (34.2) | |
| **Vitamin A rich fruits and vegetables** | | | | |
| No | 942 | 656 (69.6) | 286 (30.4) | $\chi^2 = 0.69$ p = 0.41 |
| Yes | 239 | 173 (72.4) | 66 (27.6) | |
| **Green leafy vegetables** | | | | |
| No | 735 | 505 (68.7) | 230 (31.3) | $\chi^2 = 2.1$ p = 0.15 |
| Yes | 450 | 327 (72.7) | 123 (27.3) | |

| | | | | |
|---|---|---|---|---|
| **Flesh meat (e.g. red meats, fish etc.)** | | | | |
| | 524 | 374 (71.4) | 150 (28.6) | $\chi^2 = 0.57$ p = 0.45 |
| | 656 | 455 (69.4) | 201 (30.6) | |
| **Eggs** | | | | |
| No | 1043 | 741 (71.0) | 302 (29.0) | $\chi^2 = 2.3$ p = 0.13 |
| Yes | 136 | 88 (64.7) | 48 (35.3) | |
| **Legumes** | | | | |
| No | 645 | 472 (73.2) | 173 (26.8) | $\chi^2 = 5.9$ p = 0.015 |
| Yes | 540 | 360 (66.7) | 180 (33.3) | |
| **Dairy products** | | | | |
| No | 895 | 641 (71.6) | 254 (28.4) | $\chi^2 = 3.5$ p = 0.06 |
| Yes | 290 | 191 (65.9) | 99 (34.1) | |
| **Minimum dietary diversity** | | | | |
| < 4 | 493 | 361 (73.2) | 132 (26.8) | $\chi^2 = 1.51$ , p = 0.22 |
| ≥ 4 | 268 | 185 (69.0) | 83 (31.0) | |

## Nutritional Status of Children 6-36 Months

Table 3 shows the prevalence of acute, chronic and underweight in the study sample. The proportion of children suffering from both chronic and acute malnutrition (negative deviants) was 4.2 %. Of the 1,168 children aged 6- 36 months, 67.9 % (CI: 64.5 – 71.1) were classified as positive deviant (PD).

**Table 3.** Prevalence of malnutrition among children 6-36 months.

| Variable | Frequency (n) | Mean ± S.E | Prevalence (%) |
|---|---|---|---|
| WAZ * | 1175 | -1.15±0.05 | |
| HAZ* | 1168 | -1.11±0.07 | |
| WHZ* | 1168 | -0.78±0.05 | |
| | | | |
| Underweight (WAZ < -2 SD) | 232 | | 21.4 (*CI: 18.4 - 24.7) |
| Acute malnutrition (WHZ< -2 SD) | 140 | | 12.8 (CI: 10.9 - 14.8) |
| Chronic malnutrition (HAZ < -2 SD) | 245 | | 23.1 (CI: 19.4 - 27.3) |
| | | | |
| Positive deviance (Both HAZ and WHZ ≥-2 | 820 | | 67.9 (CI: 64.5 - 71.1) |
| Negative deviance (both HAZ and WHZ <-2) | 37 | | 3.8 (CI: 2.7 - 5.2) |
| Median growers (either HAZ or WHZ <-2). | 311 | | 28.3 (CI: 25.3 - 31.5) |

**Z -scores: weight for age, height for age, weight for height, WHO Standard 2006*

**CI: 95 % confidence interval*

## Predictors of Positive Nutrition Deviance among Children Aged 6-36 Months

Bivariate analysis was done to quantify the crude association between positive nutrition deviance and selected independent variables. A number of variables including household wealth index, timely initiation of breast feeding, timely introduction of complementary foods, minimum meal frequency, minimum dietary diversity, minimum acceptable diet and a composite index of infant and young child (IYCF) practices were tested to find their association with positive deviance. Tables 4a and 4b show the predictors of positive deviance in child growth. A significantly higher proportion of PD children were younger (6–8 months), compared to children aged 24-36 months. Female children were significantly more likely to be positive deviant compared to boys. Children who were not breastfeeding were more likely to be positive deviant children. Positive deviant children were more likely to come from the Upper West and Upper East regions. Mothers of positive deviant children had higher maternal educational attainment. Mothers of positive deviant children were older (at least 35 years). Positive deviant children suffered less often from diarrhoeal infection in the past two weeks prior to the study, compared to their counterparts who were negative deviants.

**Table 4a.** Bivariate analysis of predictors of positive nutrition deviance among children aged 6-36 months.

| Characteristic | N | Nutrition Deviance Classification (%) | | |
|---|---|---|---|---|
| | | Negative deviants & median growers (HAZ) and/or WHZ <-2) | Positive deviants (HAZ) and WHZ ≥-2) | Test statistic |
| **Region of residence** | | | | |
| Northern | 465 | 41.1 [CI: 35.3 – 47.1] | 58.9 [CI: 52.9 – 64.7] | $\chi^2 = 46.9$ p < 0.001 |
| Upper East | 239 | 22.3 [CI: 18.7 – 26.3] | 77.7 [CI: 73.7 – 81.3] | |
| Upper West | 464 | 22.4 [CI: 19.5 – 25.6] | 77.6 [CI: 74.4 – 80.5 | |
| **Age of child (months)** | | | | |
| 6-8 | 131 | 16.9 [CI: 10.7 – 25.8] | 83.1 [CI: 74.2 – 89.3] | $\chi^2 = 23.9$ p = 0.001 |
| 9-11 | 148 | 24.6 [CI: 18.5– 32.0] | 75.4 [CI: 68.0 – 81.5] | |
| 12-23 | 491 | 37.1 [CI: 32.1– 42.3] | 62.9 [CI: 57.7– 67.9] | |
| 24-36 | 398 | 33.5 [CI: 27.3– 40.4] | 66.5 [CI: 59.6– 72.7] | |
| **Gender of child** | | | | |
| Male | 580 | 35.4 [CI: 31.4 – 39.6] | 64.6 [CI: 60.4 – 68.6] | $\chi^2 = 5.5$ , p = 0.01 |
| Female | 588 | 29.0 [CI: 25.0 – 33.2] | 71.0 [CI: 66.8 – 75.0] | |
| **Maternal age (years)** | | | | |
| Under 18 | 13 | 53.3 [CI: 26.6 – 78.3] | 46.7 [CI: 21.7 – 73.4] | $\chi^2 = 6.7$ , p = 0.04 |
| 18-35 | 970 | 32.9 [CI: 30.3 – 35.7] | 67.1 [CI: 64.3 – 69.7] | |
| 35+ | 204 | 25.8 [CI: 19.4 – 33.4] | 74.2 [CI: 66.6 – 80.6] | |

** 95 % confidence level (CI)*

**Table 4b.** Bivariate Analysis of predictors of positive nutrition deviance among children aged 6-36 months.

| Characteristic | N | Nutrition Deviance Classification (%) | | |
|---|---|---|---|---|
| | | Negative | Positive | Test statistic |
| **Child currently breastfeeding?** | | | | |
| Yes | 894 | 34.0 [CI: 31.1 – 37.0] | 66.0 [CI: 63.0 – 68.9] | $\chi^2 = 5.7$ , p = 0.04 |
| No | 268 | 26.1 [CI: 19.4 – 34.2] | 73.9 [CI: 65.8 – 80.6] | |
| **Consumption of roots and tubers** | | | | |
| No | 913 | 30.2 [CI: 27.2 – 33.4] | 69.8 [CI: 66.6 – 72.8] | $\chi^2 = 7.7$ , p = 0.03 |
| Yes | 252 | 39.4 [CI: 31.1 – 48.3] | 60.6 [CI: 51.7 – 68.9] | |
| **Maternal Religion** | | | | |

| | | | | |
|---|---|---|---|---|
| Christianity | 545 | 21.8 [CI: 18.9 – 25.1] | 78.2 [CI: 74.9 – 81.1] | $\chi^2$ = 41.1 , p < 0.001 |
| Islam | 558 | 39.8 [CI: 34.7 – 45.2] | 60.2 [CI: 54.8 – 65.3] | |
| African Traditional Religion | 65 | 26.8 [CI: 18.9 – 36.6] | 73.2 [CI: 63.4 – 81.1] | |
| **Maternal Education** | | | | |
| None | 827 | 34.5 [CI: 29.8 – 39.4] | 65.5 [CI: 60.6 – 70.2] | $\chi^2$ = 7.9 , p = 0.03 |
| Low | 312 | 26.8 [CI: 22.8 – 31.1] | 73.2 [CI: 68.9 – 77.2] | |
| High | 29 | 20.6 [CI: 10.8 – 35.8] | 79.4 [CI: 64.2 – 89.2] | |
| **Child had diarrhoea in the past two weeks?** | | | | |
| Yes | 392 | 38.0 [CI: 33.9 – 44.3] | 61.0 [CI: 55.7 – 66.1] | $\chi^2$ = 13.1 , p = 0.001 |
| No | 776 | 28.6 [CI: 25.0 – 32.4] | 71.4 [CI: 67.6 – 75.0] | |
| **Place of delivery** | | | | |
| Home | 520 | 35.7 [CI: 30.5 – 41.3] | 64.3 [CI: 58.7 – 69.5] | $\chi^2$ = 7.6 , p = 0.02 |
| Institutional | 641 | 28.2 [CI: 24.9 – 31.8] | 71.8 [CI: 68.2 – 75.1] | |

** 95 % confidence level (CI)*

Our data showed that breastfed children aged 6-23 months were not getting adequate complementary foods. The dietary diversity score of such children was significantly lower than their counterparts who were not breast feeding (2.8 versus 3.7), F (1,765) = 4.6, p = 0.032. Additionally, the mean meal frequency in the past 24 hours prior to the study for breast feeding children was lower than that of non-breast feeding children (2.5 versus 5.5), F (1,784) = 13.0, p < 0.001.

Multivariable logistic regression analyses showed that being a female child, resident in the Upper West Region, younger children, non-breast breastfeeding children were factors contributing significantly to positive deviance (PD (Table 5). Compared to the Northern Region, children in the Upper West region were 2.5 times more likely of becoming positive deviant (OR= 2.50, CI= 1.67 - 3.74) and children in the Upper East Region were 2.6 times more likely of becoming positive deviant (OR= 2.60, CI= 1.64 - 4.11).

The data showed that children who had no diarrhoea were 1.9 times more likely of being positive deviant [AOR 1.93; 95% CI (1.34 - 2.76)] compared to children who had diarrhoea in the last two weeks prior to study. Female children were significantly more likely to be positive deviant [AOR 1.88; 95% CI (1.32 - 2.67)]. Younger children (6-8 months) were 13.7 times more likely to be positive deviant children [AOR 13.66; 95% CI (5.51 - 33.90)], compared to children aged 24-36 months.

Of all the predictors of positive deviance, age of the child contributed most (Wald = 37.4, p < 0.001) to the variation of positive deviance of growth.

**Table 5.** Multivariate analysis of the determinants of positive nutrition deviance (Low socio-economic households only).

| | Wald | Sig. | Exp(B) | 95% C.I.for EXP(B) | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| **Region of residence (reference: Northern)** | 26.8 | <0.000 | | | |
| Upper West Region | 19.7 | <0.001 | 2.50 | 1.67 | 3.74 |
| Upper East Region | 16.4 | <0.001 | 2.60 | 1.64 | 4.11 |
| Gender (female child) | 12.2 | <0.001 | 1.88 | 1.32 | 2.67 |
| Child had no diarrhoea in the last two weeks prior to study | 12.7 | <0.001 | 1.93 | 1.34 | 2.76 |
| Child not breast feeding | 13.7 | <0.001 | 2.80 | 1.62 | 4.82 |
| **Age of child (reference: 24-36 months)** | 37.4 | <0.001 | | | |
| 6-8 | 31.8 | <0.001 | 13.66 | 5.51 | 33.90 |
| 9-11 | 15.8 | <0.001 | 3.90 | 2.00 | 7.62 |
| 12-23 | 9.6 | 0.002 | 2.20 | 1.34 | 3.61 |
| Constant | 23.2 | <0.001 | 0.25 | | |

## Discussion

This paper presents analysis of positive nutrition deviance aimed at identifying characteristics of young children who, despite economic constraints prevalent in the study area, were able to achieve positive nutritional outcomes.

Socio-economic status as measured by household wealth index was not an important determinant of positive deviance in child growth in our study sample. This gives an indication that economic constraints did not play into the picture of positive deviance. Multivariate analysis was performed on the entire sample and on a separate subset comprising households of low household wealth index**.** By using households of similar living conditions, it was possible to provide possible answers to the fundamental question of: "What is it that certain households have been able to do, despite low socioeconomic standing that

has resulted in normal nutritional status?

A number of variables including child morbidity, timely initiation of breast feeding, timely introduction of complementary foods, minimum meal frequency, minimum dietary diversity, minimum acceptable diet and a composite index of infant and young child (IYCF) practices were tested to find their association with positive deviance. The results showed that these key indicators of infant and young child feeding practices were however, not important predictors of positive deviance in the study population.

In the present study, factors contributing significantly to positive deviance (PD) in rural households of low socioeconomic status were children of younger ages (6–8) months; children of female sex, residence in the Upper West Region, absence of diarrhoeal infection and non-breast feeding status.

Many other factors that associated with positive deviance in bivariate analysis but failed to reach significance level in multivariable regression analyses were institutional delivery, high maternal educational attainment, Christian religion following and older maternal age (at least 35 years).

Though children aged 6-8 months were less likely to meet minimum dietary diversity, they were more likely to become positive deviant**.** A significantly higher proportion of PD children were younger (6–8 months), compared to children aged 24-36 months.

We found female children more likely to be positive deviants, contrary to what was reported in other countries including Bangladesh, where male children were three times more likely to be positive deviants as compared to girl children [12]. Male children were more likely to be stunted than their counterpart females, a finding that has been reported by earlier studies in other African countries [13-15]. The exact factors contributing to this male vulnerability is unclear but it is unlikely to be the result of gender preference [13, 16]. The male vulnerability to malnutrition may be biological and the fact that male infants are at greater risk of infection because of greater tendency to explore the environment compared to female counterparts. It has been suggested that despite the improvement in medical care, environmental stresses have harsher effects on males than females in early life [17].

From the analysis we found that children who were not breastfeeding were more likely to be positive nutritional deviants as compared to their counterparts who were breastfeeding. This finding may be explained by the fact that, breast milk alone is inadequate to meet the nutritional needs of children aged 6-24 months but rather a combination of breastfeeding and adequate complementary foods is needed [18]. Similarly, in rural Senegal it was reported that current breast-feeding was associated with a significantly lower height-for-age after adjustment for age [19]. It appears that breast feeding children aged 6-23 months are not getting adequate complementary foods. In our study sample, the dietary diversity score of such children was significantly lower than their counterparts who were not breast feeding. Additionally, the mean meal frequency in the past 24 hours prior to the study for breast feeding children was lower than that of non-breast feeding children. All these point to the fact that breast feeding children are at greater risk of being fed on sub-optimal complementary feeding regime and this has great potential of compromising their growth performance. In view of this, we suggest all mothers, especially those that are breast feeding should be targeted for behaviour change communication interventions designed to promote and enhance complementary feeding.

Positive deviant children suffered less often from diarrhoeal infection in the past two weeks prior to the study, compared to their counterparts who were negative deviants. Usually, the incidence of diarrhoeal disease is directly related to the quality of water and sanitation services, as well as behaviors that are embodied in various sanitation and hygiene practices. This therefore means that occurrence of diarrhoea gives an indication of hygiene and sanitation conditions. A significant proportion of the negative deviant children/median growers had suffered from diarrhoea within two weeks prior to the study, compared to positive deviant children. Similar findings had been reported from several countries including Ghana and Bangladesh [12, 20, 21].

Under-nutrition and childhood morbidity have a synergistic relationship. The two conditions act in such a way that illness can suppress appetite precipitating under nutrition of a child while, on the other hand, nutritional deficiencies increase the susceptibility of the child to infectious diseases [22]. Generally, improving dietary intake to recommended levels together with the elimination of diarrhoea and febrile illness at the same time would be necessary to achieve optimal child growth. The implication of this finding is that proper personal and environmental cleanliness is associated with positive deviance and that interventions to reduce morbidity from diarrhoea may benefit children's growth in this population.

The prevalence of acute under-nutrition was over 10 %, a level considered to be serious according to the World Health Organization (WHO). The overall prevalence of chronic malnutrition was as high as 23.1 %, which indicates a serious malnutrition situation as judged by the WHO criteria [23, 24].

Poor complementary feeding practices contribute to inadequate energy and protein intake and childhood under nutrition [25-27]. Therefore, complementary feeding indicators were also assessed as predictors of nutritional adequacy. Families of positive deviant children reported desirable IYCF be-

haviors, especially timely initiation of breast feeding. The analysis of data collected on feeding practices showed that only 46.1 % of the children aged 6-23 months met the minimum acceptable diet suggesting over 50 % were on poor diet quality. Surprisingly, none of the WHO recommended complementary feeding indicators (Minimum meal frequency, minimum dietary diversity, and minimum acceptable diet) was associated with positive deviance in growth among children aged 6-23 months. In bivariate analyses, a composite index of infant and child feeding practices was also not significantly different in the two groups of children. The index comprised the elements: current breast feeding status, timely initiation of breast feeding, whether or not the child was given prelacteal food, age at which complementary foods were introduced, adequacy of meal frequency in the past 24 hours and 24 hour dietary diversity score. A study in Senegal also reported that the feeding index was not associated with height-for-age z-score in either bivariate analyses or in general linear models adjusting for a number of variables [19].

The apparent lack of association between child feeding practices and positive deviance may be due to the fact that there was very little variation in the study population with respect to these indicators. There was little variation in the dietary intake of positive deviants and the rest of the children (that is negative deviants and median growers). This finding is consistent with findings from other studies conducted in the Brong Ahafo Region of Ghana where with the exception of dietary zinc intake, dietary variables were generally not significantly associated with child growth [20].

Findings on the relationship between feeding practices and child growth have been mixed. A survey conducted in Mexico found that measures of recommended breastfeeding and complementary feeding practices were not associated with growth when family economics and other factors were included in logistic regression models [28].

An earlier study carried out in Senegal (Sahelian West Africa country), concluded that dietary diversity in the last 24hrs and frequencies of consumption of animal source foods (animal milk, meat, fish/eggs/poultry) over the last week were not associated with growth in height [19].

However, in seven Latin American countries, it was reported that recommended child feeding practices were positively associated with height-for-age z-score with a stronger effect for children of lower socio-economic status [8]. Dietary diversity among 6–23-month-old children was found to be positively associated with height-for-age z-score in seven of 11 countries when other variables were included in the models [29].

A major strength of this paper lies in the fact that it is about the first to identify the main determinants of positive deviance in Northern Ghana. Most studies tend to focus on the prevalence and determinants of malnutrition. However, as pointed out by many scholars, the determinants of 'positive deviance' are not necessarily the converse of poor growth. It has been hypothesized that the mechanisms operating to produce 'positive deviance' and 'negative deviance' are different [30]. A factor that may be associated with 'negative deviance' need not be inversely associated with 'positive deviance'. One other uniqueness of the present study is that it defined positive deviance taking into consideration the absence of both chronic and acute malnutrition.

## Conclusions

This paper has identified some child characteristics and key growth promoting behaviors that enable children in Northern Ghana to perform better in terms of growth under conditions which their counterparts failed. One significant modifiable factor contributing to positive deviance is protection of children from diarrhoeal infection but the age of child was a major determinant of positive deviance.

Our analyses showed that children who were not breastfeeding were more likely to be positive nutritional deviants as compared to their counterparts who were breastfeeding. Evidence from our sample suggest that breast feeding children were at greater risk of being fed on sub-optimal complementary feeding regime and this has great potential of compromising their growth performance.

It is difficult however, to make firm inferences about the contribution of feeding behaviors as most of the major feeding indicators were not associated with positive deviance of child growth. We therefore suggest that intervention studies that aim at improving feeding practices among infants and young children in low-income settings would allow for a better assessment of the effect dietary quantity and quality have on positive deviance of child growth.

## Limitations of the study

Our design was a cross sectional study and as with all such studies we cannot ascribe causations to the relationships found in the current study, and based on self-report we are not sure whether the respondents may or may not have misreported. However, because the questionnaire was anonymous we have no reason to believe that the respondents may have knowingly misreported in our survey.

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## References

1. UNICEF. Strategy for improved nutrition of children and women in developing countries. New York: UNICEF Nutrition Section, 1990.

2. TUFTS University: Positive deviance in children nutrition. Protocol for project guidelines 1-9: Tufts University. 1987, 1-9.

3. Chavez A, Martinez C, Soberanes B. The effects of malnutrition on Human Development. A 24 year study of Well Nourished and Malnourished children living in a poor Mexican Village. WHO INFDC. 1995, 79-122.

4. UN ACC/SCN: Second report on the world nutrition situation In Global and regional results. 1: 1-112. Geneva: Administrative Committee on Coordination–Subcommittee on Nutrition. 1992, 1-112.

5. Shekhar M, Habicht JP, Latham MC. Use of positive-negative deviant analyses to improve programme targeting and services: Example from the Tamil Nadu Integrated Nutrition Project. International Journal of Epidemiology. 1992, 21: 707-713.

6. Zeitilin MF, Ghassemi H, Mansor M. Positive deviance in child nutrition. Tokyo: UN university press, 1990.

7. WHO/UNICEF/IFPRI/UCDavis/FANTA/AED/USAID: Indicators for assessing infant and young child feeding practices. Part 1: Definitions Geneva: World Health Organization, 2008.

8. Ruel MT, Menon P. Child feeding practices are associated with child nutritional status in Latin America: innovative uses of the demographic and health surveys. The Journal of Nutrition. 2002, 132: 1180–1187.

9. World Health Organization. Indicators for assessing infant and young child feeding practices Part 1 Definitions. Washington DC [USA]. World Health Organization, Dept. of Child and Adolescent Health and Development. 2007.

10. WHO, UNICEF, USAID, FANTA, AED, UC DAVIS. IFPRI. Indicators for assessing infant and young child feeding practices part 2: measurement Geneva: The World Health Organization. 2010.

11. WHO. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. Geneva WHO. 2006.

12. Range SKK, Naved R, Bhattarai S. Child Care Practices Associated with Positive and Negative Nutritional Outcomes for Children in Bangladesh. A Descriptive Analysis.

13. Medhin G, Hanlon C, Dewey M, Alem A, Tesfaye F et al. Prevalence and predictors of under nutrition among infants aged six and twelve months in Butajira, Ethiopia: the P-MaMiE Birth Cohort. BMC Public Health. 2010, 10: 10-27.

14. Getahun Z, Urga K, Ganebo T, Nigatu A. Review of the status of malnutrition and trends in Ethiopia. Ethiop J Health Dev. 2001, 15(2): 55–74.

15. Wamani H, Åstrøm AN, Peterson S, Tumwine JK, Tylleskär T. Boys are more stunted than girls in Sub-Saharan Africa: A meta-analysis of 16 demographic and health surveys. BMC Pediatr. 2007, 7: 17–26.

16. Hadley C, Lindstrom D, Tessema F, Belachew T. Gender bias in the food insecurity experience of Ethiopian adolescents. Soc Sci Med. 2008, 66: 427–438.

17. Wells JC. Natural selection and sex differences in morbidity and mortality in early life. J Theor Biol. 2000, 202: 65-76.

18. Dacey SJ, Travers FJ. Human Development Across the Lifespan. 5th ed. edn. New York. McGraw Hill,2004.

19. Ntab B, Simondon KB, Milet J, Cisse B, Sokhna C, Boulanger D, Simondon F. A Young Child Feeding Index Is Not Associated with Either Height-for-Age or Height Velocity in Rural Senegalese. Children J Nutr. 2005, 135: 457–464.

20. Lartey A, Manu A, Brown KH, Peerson JM, Dewey KG. Predictors of growth from 1 to 18 months among breast-fed Ghanaian infants. Eur J Clin Nutr. 2000, 54(1): 41-49.

21. Pandey C, O'Loughlin R. Factors influencing deviance in growth of children in rural West Bengal. Field Exchange. 2003, 18:6.

22. Yadav S. Newborn care: traditional practices in Nepal. Student BMJ 2007, 15:293-336.

23. World Health Organization (WHO), Food and Agriculture Organization (FAO): International Conference on Nutrition In Final Report. 1992: 9-55.

24. WHO: The Management of Nutrition in Major Emergencies

Geneva: WHO, UNHCR, IFRC, WFP, 2000.

25. Fikree FF, Tazeen SA, Jill MD, Rahbar MH. Newborn care practices in low socioeconomic settlements of Karachi, Pakistan. Social Science Direct and Medicine. 2005, 60: 911-921.

26. Nti CA, Lartey A. Effect of caregiver feeding behaviours on child nutritional status in rural Ghana. International Journal of Consumer Studies. 2007, 31(3): 303-309.

27. Ghana Statistical Service (GSS), Ghana Health Service (GHS), ICF Macro: Ghana Demographic and Health Survey (GDHS) 2008. Accra, Ghana: GSS, GHS, and ICF Macro. 2009.

28. Gonzalez-Cossio T, Rivera-Dommarco J, Moreno-Macias H, Monterrubio EA, Sepulveda J. Poor compliance with appropriate feeding practices in children under 2 yr in Mexico. The Journal of Nutrition 2006, 136:2928–2933.

29. Arimond M, Ruel MT. Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. The Journal of Nutrition. 2004, 134: 2579–2585.

30. Shekar M, Habicht JP, Latham MC. Is positive deviance in growth simply the converse of negative deviance?. Food and Nutrition Bulletin. 1991, 13(1): 7–11.